(Jesus), G. Ingham (Merton), A. L. Ormerod (New). Second Class: D. Berridge (Wadham), P. Henderson (Queen's), A. E. Richardson (Wadham), F. R. L. Wilson (Keble). Third Class: C. J. M. Parkinson (Jesus), H. Wynne-Finch (New). Fourth Class: S. Wellby (Trinity).

Physiology.—First Class: P. S. Hichens (Magdalen), H. H. G. Knapp (non-Coll.), A. C. Latham (Balliol), E. Mallam (Magdalen), W. Ramsden (Keble). Second Class: G. J. Conford (Christ Church), E. Stainer (Magdalen). Third Class: S. B. Billups (non-Coll.). Fourth Class: J. S. Clouston (Magdalen).

Physics.—First Class: S. A. F. White (Wadham). Second Class: G. M. Grace (Jesus). Third Class: none. Fourth Class: F. W. Bown (University), J. C. W. Herschel (Christ Church).

Morphology.—First Class: R. W. T. Günther (Magdalen).

Botany.—Second Class: O. V. Darbishire (Balliol).

Women:—Louisa Woodcock is placed in the Second Class, Morphology.

University Extension.—In a Convocation held on Tuesday the following persons were declared on a scrutiny to be duly elected as delegates, under the provisions of the statute Of the delegates for the extension of teaching beyond the limits of the University:—H. J. Mackinder, M.A., Student of Christ Church; W. W. Fisher, M.A., Corpus Christi College, Aldrichian Demonstrator of Chemistry; J. F. Bright, D.D., Master of University College; A. Sidgwick, M.A., Fellow of Corpus Christi College; J. Wells, M.A., Fellow of Wadham College; and the Rev. W. Lock, M.A., Fellow of Magdalen College.

The Encænia.—In a Convocation holden in the Sheldonian Theatre on Wednesday, June 22, the degree of D.C.L. (*honoris causâ*) was conferred upon the following persons:—

His Excellency, William Henry Waddington, Ambassador Extraordinary and Minister Plenipotentiary from the French Republic at the Court of St. James, Honorary Fellow of Trinity College, Cambridge, Hon. LL.D.

His Highness the Thakore of Gondal.

The Very Rev. Henry George Liddell, D.D., late Dean of Christ Church.

Edward Caird, M.A., Professor of Moral Philosophy in the University of Glasgow, formerly Fellow of Merton.

W. M. Flinders Petrie.

The Rev. John Gwynn, D.D., Regius Professor of Divinity in the University of Dublin.

Daniel John Cunningham, M.D., Professor of Anatomy and Chirurgery in the University of Dublin.

Edward Dowden, LL.D., Erasmus Smith's Professor of Oratory in the University of Dublin.

The Rev. John P. Mahaffy, D.D., Professor of Ancient History in the University of Dublin.

Benjamin Williamson, M.A., Sc.D., Fellow of Trinity College, Dublin.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 2.—"On Current Curves." By Major R. L. Hippisley, R.E. Communicated by Major MacMahon, F.R.S.

(1) Starting with the equations

$$i = \frac{E}{R}\left(1 - e^{-\frac{Rt}{L}}\right)$$

and

$$i = \frac{E}{\sqrt{(R^2+p^2L^2)}}\sin(pt - \theta),$$

which represent the curves of currents in circuits *without* iron cores, according as the impressed E.M.F. is constant or varying as sin pt, we can determine the curves according to which the current rises and falls in circuits *with* iron cores, both for a constant impressed E.M.F. and for a sinusoidal E.M.F.

(2) In the first case, with constant applied E.M.F., we can determine by Lagrange's formula of interpolation the equation to the (B, H) curve of the particular core under consideration. This will be of the form

$$B = a_0 + a_1H + a_2H^2 + \ldots + a_nH^n,$$

where n is one less than the number of observed simultaneous values of B and H from which the equation is calculated. Substituting in the equation

$$E - \frac{dB}{dt} = Ri,$$

we get, after integration,

$$t = b_0 \log \frac{E}{E - Ri} - b_1i - b_2i^2 - \&c., \text{ to } n + 1 \text{ terms},$$

b_0, b_1, b_2, &c., being numerical. The paper gives b_0, b_1, b_2, &c., in terms of the constants of the circuit, &c.

The corresponding equation when the E.M.F. is removed and the current is dying away is

$$t = c_0 \log \frac{E}{Ri} - c_1i - c_2i^2 - \&c. + \text{a constant}.$$

From these two equations the curves can be plotted.

(3) This method is not applicable to the case in which the impressed E.M.F. is sinusoidal, on account of difficulties of integration. But both cases can be treated in another way:—Take a series of points on the (B, H) curve of the iron core, such that the chords joining them practically coincide with the curve itself. Let B_κ, H_κ, and $B_{\kappa+1}$, $H_{\kappa+1}$, be the co-ordinates of two consecutive points. The equation to the curve between these points is approximately

$$B = m_{\kappa+1}H + \text{constant},$$

where

$$m_{\kappa+1} = \frac{B_{\kappa+1} - B_\kappa}{H_{\kappa+1} - H_\kappa}.$$

Substituting in the equation

$$E - \frac{dB}{dt} = Ri,$$

we get, after integration,

$$t_{\kappa+1} = t_\kappa + \frac{m_{\kappa+1}L}{R} \log \frac{E - Ri_\kappa}{E - Ri_{\kappa+1}},$$

which is true to a very close approximation for any simultaneous values of t and i between the above limits. From this equation, by determining the various values of m, and remembering that t_0 and i_0 are both zero, we can determine in succession the times at which the current has the known values 0, $\frac{H_1}{L}$, $\frac{H_2}{L}$, . . . &c., and the current curve can be plotted.

On making $E = 0$ in the original differential equation, and observing the proper limits, we get

$$t_{n+1} = t_n + \frac{m_{n+1}L}{R} \log \frac{H_n}{H_{n+1}}$$

as the equation to the curve representing the dying away of the current when the E.M.F. is withdrawn; m_n, m_{n+1} being determined from the descending (B, H) curve.

(4) When the impressed E.M.F. is sinusoidal, we substitute for dB/dt in the equation

$$E \sin pt - \frac{dB}{dt} = Ri,$$

having determined the various values of dB/dt, as in the foregoing.

As by the present method the value of m changes *abruptly* from m_κ to $m_{\kappa+1}$, we must employ the *general* solution of the above, which for the interval t_κ, $t_{\kappa+1}$, is

$$i = \frac{E}{\sqrt{(R^2 + m_{\kappa+1}{}^2p^2L^2}}\sin(pt - \theta_{\kappa+1}) + A_{\kappa+1}e^{-Rt/m_{\kappa+1}L},$$

in order that the current at the commencement of the interval t_κ, $t_{\kappa+1}$, may have the same value which it had at the end of the interval $t_{\kappa-1}t_\kappa$. The complementary function

$$A_{\kappa+1}e^{-Rt/m_{\kappa+1}L},$$

enables us to insure this condition; for, by taking the constant $A_{\kappa+1}$ of such a value that the above equation is satisfied when $i = i_\kappa$ and $t = t_\kappa$, there is no abrupt change in the current. The complementary function, in fact, represents the gradual dying away of whatever excess or defect of current there would be in the circuit when m changes.

This equation is true for all values of i between i_κ and $i_{\kappa+1}$; and, therefore, enables us to find the time, $t_{\kappa+1}$, at which the current attains the known value $H_{\kappa+1}/L$.

By changing κ into $\kappa + 1$, we obtain similarly the time $t_{\kappa+2}$ at which the current has the value $H_{\kappa+2}/L$, and so on.

Thus the determination of $t_{\kappa+1}$ is made to depend upon t_κ, and in order to make a start we must assume that the value of *i* is known for some definite value of *t*. It is not of much consequence what assumption, within reason, is made, as, though the calculated curves will vary with the assumption made, they will all eventually merge into the true periodic current curve at some point which will be exhibited when the *first* evanescence of $Ae^{-Rt/mL}$ takes place.

As this complementary function is a continually decreasing quantity, it becomes negligible when it is allowed time enough. This opportunity is afforded when the straighter portions of the (B, H) curve are reached.

In the paper are given diagrams showing the plotted curves of current calculated from the above equations, together with tables of calculated values.

"The Conditions of the Formation and Decomposition of Nitrous Acid." By V. H. Veley.

The main points of this inquiry may briefly be summarized as follows:—

(1) The formation of the impurity of nitrogen peroxide in nitric acid, imparting to it the well-known yellow tint, takes place in the case of the more concentrated acid, even at a temperature of 30°, and of the less concentrated acids at from 100°–150°, even when the acid is not unduly exposed to sunlight.

(2) The reaction between nitric oxide and nitric acid may be regarded as reversible, thus:—

$$2NO + HNO_3 + H_2O \rightleftarrows 3HNO_2,$$

provided that the acid be sufficiently dilute, and the temperature sufficiently low. Under these conditions equilibrium is established between the masses of nitric acids when the ratio of the former to the latter is, roughly speaking, as 9 : 1. The actual ratio varies slightly on the one side or the other, according to the conditions of the experiments. With more concentrated acids and at higher temperatures the chemical changes taking place are more complicated, and the decomposition of the acid more profound.

(3) The decomposition of solutions containing both nitric and nitrous acids is also investigated; the rate of the change is shown to be proportional to the mass of the nitrous acid undergoing change. The curve representing the amount of chemical decomposition in terms of the mass present is shown to be hyperbolic, and illustrative of the law

$$\text{(I.)}\ \frac{dC}{aT} = -\frac{C^2}{M}.$$

This holds good, whatever be the method employed for the production of the nitrous-nitric acid solution.

The observed values for C or the concentration of the nitrous acid are concordant with those calculated according to the above differential equation within the limits of experimental error.

The rate is dependent upon the ratio of the masses of the nitrous and nitric acid, being the more rapid, the greater the proportion of the former to that of the latter.

In the particular case of the liquid prepared from nitric oxide and nitric acid, wherein the reproduction of solutions of similar concentration presents less difficulty, it is shown that as the temperature increases in arithmetical the rate of change increases in geometrical proportion, in accordance with the equation

$$\text{(II.)}\ v_t = v_{t_1} k^{(t-t_1)},$$

the value for *k* being 0·0158.

Finally, though the nitrous-nitric acid solutions behave in a similar manner as regards the diminution of the mass of the nitrous acid, yet, in other respects, such as evolution of gases and the action upon metals, they are dissimilar.

"On the Method of Examination of Photographic Objectives at the Kew Observatory." By Major L. Darwin. Communicated by Captain Abney, R.E., F.R.S.

The paper describes the method of examination of photographic objectives which has been adopted at the Kew Observatory, chiefly on the recommendation of the author. In selecting and devising the different tests, Major Darwin acted in co-operation with Mr. Whipple, the Superintendent of the Observatory, and was aided by consultations with Captain Abney.

The object of the examination is to enable any one, on the payment of a small fee, to obtain an authoritative statement or certificate as to the quality of an objective for ordinary purposes.

An example is first given of a "Certificate of Examination," such as would be obtained from Kew, and then the different tests are discussed in detail. The following are the different items in the Certificate of Examination, or the various tests to which the objective is subjected:—

(1) to (4) None of this information forms part of the result of the testing.

(5) *Number of External Reflecting Surfaces.*

(6) *Centering in Mount.*

(7) *Visible Defects, such as Veins, Feathers, &c.*

(8) *Flare Spot.*

(9) *Effective Aperture of Stops*, which is given for each one supplied with the objective. In recording the results, it is proposed that the system of numbering recommended by the International Photographic Congress of Paris of 1889 should be adopted.

(10) *Angle of Cone of Illumination, &c.*

(11) *Principal Focal Length.*—This is found by revolving the camera through a known angle, and measuring the movement of the image of a distant object on the ground glass; with the Testing Camera it is so arranged that an angular movement can be given with great ease and accuracy, and that the angle is such that half the focal length is directly read off on a scale on the ground glass. The observation is made when the image is at a point some 14 degrees from the axis of the objective, and the effect of distortion and curvature of the field is discussed; it is proved that the focal length thus obtained, even though it may not be identical with the principal focal length as measured on the axis, is nevertheless what the photographer in reality wants to ascertain.

(12) *Curvature of the Field.*

(13) *Distortion.*—This test depends in principle on ascertaining the sagitta or deflection in the image of a straight line along one side of the plate. In the discussion it is shown that to give the total distortion near the edge of the plate would not answer practical requirements, and that the proposed method of examination does give the most useful information that can be supplied.

(14) *Definition.*—This is found by ascertaining what is the thinnest black line the image of which is just visible when seen against a bright background. It is shown that this is the best method that could be devised of measuring the defining power of an objective, and that it is not open to serious objections on theoretical grounds.

(15) *Achromatism.*—In the Certificate is recorded under this heading the difference of focus between an object when seen in white light and the same when seen in blue or red light.

(16) *Astigmatism.*—This test is performed by measuring the distance between the focal lines at a position equivalent to the corner of the plate, and by calculating from the result thus obtained the approximate diameter of the disk of diffusion due to astigmatism.

(17) *Illumination of the Field.*—The method of examination, which is due to Captain Abney, is described.

"On Certain Ternary Alloys. Part VI. Alloys containing Aluminium, together with Lead (or Bismuth) and Tin (or Silver)." By C. R. Alder Wright, D.Sc., F.R.S., Lecturer on Chemistry and Physics in St. Mary's Hospital Medical School.

The experiments described in this paper are a continuation of the previous researches on the miscibility of molten metals under such conditions that whereas two of the metals, A and B, will not mix together in all proportions, the third, C, is miscible in all proportions with either A or B severally. The alloys now investigated are those where A is lead (or bismuth); B, aluminium; and C, tin (or silver). They show considerable analogy with, and resemblance to, those previously described containing the same metals as A and C respectively, but zinc instead of aluminium as B; but certain differences are noticeable: thus the substitution of aluminium for zinc invariably *raises the critical curve*, causing it to lie *outside* its former position, this being observed whether the heavy immiscible metal, A, be lead or bismuth, and whether the solvent metal, C, be tin or silver. On the other hand, the substitution of bismuth for lead always *depresses the critical curve*, causing it to lie *inside* its former position; this being equally observed whether the lighter immiscible metal, B, be zinc or aluminium, and whether the solvent metal, C, be tin or silver. In the case of the metals bismuth-zinc-silver and lead-zinc-silver, peculiar bulges (inwards and outwards) were noticed in certain parts of the critical curve, due to the formation of definite atomic compounds, $AgZn_5$ and Ag_4Zn_5; no corresponding indications are observed when aluminium replaces zinc in these mixtures, whence apparently similar atomic combinations of silver and aluminium are not formed. On the other hand, lead-zinc-tin and lead-aluminium-tin alloys correspond sharply with each other in that they are the only alloys yet examined where the direction of slope of the tie lines is not the same throughout; in each case the lower ties slope to the left (lead side), and the upper ones to the right (zinc side); the point where the angle of slope of the lower ties is a maximum corresponds in each case with a ratio between lead and tin in the heavier alloys formed approximating pretty closely to that indicated by the formula Pb_3Sn, suggesting that the sloping of the lower ties is due to the formation of this definite atomic compound. The upper ties in each case exhibit a tendency to converge towards a point on the right-hand side of the curve, approximately where the ratios of zinc to tin and aluminium to tin respectively are those indicated by the formulæ Zn_4Sn, and Al_4Sn; suggesting the existence of these definite compounds.

In the course of the experiments, it is shown incidentally that bismuth and aluminium are practically immiscible when molten: at about 900° C. bismuth dissolves less than 0·1 per cent. of aluminium, whilst aluminium dissolves about 2·0 per cent. of bismuth. The binary alloys of bismuth and aluminium stated by previous observers to exist are simply more or less intimate intermixtures of the two metallic solutions.

"On the Theory of Electrodynamics as affected by the nature of the Mechanical Stresses in Excited Dielectrics." By J. Larmor.

The various theories of electrodynamics are examined from the standpoint of their ability to explain the experimental facts as to pressures in liquid dielectrics which have been made out by Quincke and other experimenters.

The principal conclusions are as follow:—

(1) It follows from the experimental results that the stress in an excited fluid dielectric between two condenser plates consists, at any rate to a first approximation, of a tension along the lines of force and an equal pressure in all directions at right angles to them, superposed upon such stress as would exist in a vacuum with the same value of the electric force.

(2) It follows from experiments that the numerical value of these additional equal tensions and pressures is, at any rate to a first approximation, $(K - 1)F^2/8\pi$, where F is the electric force, and K the inductive capacity.

(3) Such a distribution of equal tension and pressure is necessarily the result of a uniform volume distribution of energy in the dielectric, irrespective of what theory is adopted as to its mode of excitation.

(4) If we consider the mode of excitation to be a *quasi*-magnetic polarization of its molecules, the numerical magnitude of these stresses should be

$$\frac{K - 1}{8\pi}F^2\left(1 + \lambda\frac{K - 1}{4\pi}\right),$$

where λ is a coefficient which depends on the molecular discreteness of the medium, and is probably not very different from the value $\frac{4}{3}\pi$. A discrete polarization of the molecules does not account for the stress, so far as this coefficient is concerned.

(5) The stress which would exist in a vacuum dielectric is certainly due in part to a volume distribution of energy, as is shown by the propagation of electric waves across a vacuum. There is thus no reason left for assuming any part of it to be due to a distribution of energy at its two surfaces, acting directly on each other at a distance. There is therefore ground for assuming a purely volume distribution of energy in a vacuous space, leading to a tension $(1/8\pi)F^2$ along the lines of force, and a pressure $(1/8\pi)F^2$ at right angles to them.

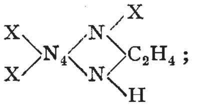
(6) The *quasi*-magnetic polarization theory rests on the notion of a dielectric excited by a surface charge on the plates, and therefore involves a surface-distribution of energy, unless in the extreme case when the absolute value of K is very great; in that case a slight surface-charge produces a great polarization effect, and in the limit the polarization may be taken as self-excited. Thus the absence of a surface-distribution of energy leads to Maxwell's displacement-theory, in which all electric currents are circuital, and the equations of electrodynamics are therefore ascertained.

(7) It appears that even this limiting polarization theory must be replaced, on account of the stress-formula in (4), by some dynamical theory of displacement of a more continuous character.

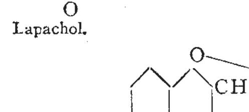
"The Hippocampus." By Dr. Alex. Hill.

Observations upon the brains of various aquatic mammals which show that, when the sense of smell is completely absent, as judged by the total suppression of the olfactory bulb and nerves, the essential constituent of the "hippocampus," the fascia dentata, is absent also. Amongst other mammals the fascia dentata varies in development as the olfactory bulb.

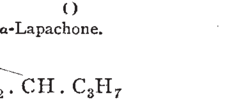
Chemical Society, June 2.—Dr. W. H. Perkin, F.R.S. Vice-President, in the chair.—The following papers were read:—Ethylene derivatives of diazoamido-compounds, by R. Meldola and F. W. Streatfeild. The authors find that ethylene diazoamides result from the action of ethylene dibromide and caustic alkali on diazoamides dissolved in alcohol. The products thus obtained have the general formula—



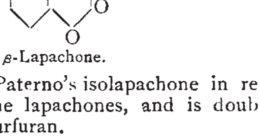
mixed ethylene-diazoamides can also be obtained. These compounds are very stable, and are decomposed by prolonged contact with concentrated hydrochloric acid at ordinary temperatures.—The action of light on silver chloride, by H. B. Baker. The small loss in weight which silver chloride undergoes on exposure to light has led the author to investigate whether oxygen is absorbed at the same time that chlorine is evolved, Robert Hunt having long ago stated that such an absorption does occur. Silver chloride was placed in a bulb connected with a long tube standing over caustic potash solution; the atmosphere consisted of air or oxygen. On exposing this apparatus to light, the liquid rose in the tube, showing that oxygen had been absorbed. The proportion in which the elements silver, chlorine, and oxygen were contained in the darkened substance was then determined. The results agree approximately with the formula Ag_2ClO. The experimental difficulties in the way of an exact determination of the composition of the darkened product are very great, owing to the fact that the dark substance is mixed with an enormous quantity of unchanged silver chloride. The product of exposure to light never contains more than 0·1 gram of the dark-coloured substance per 50 grams of unaltered silver chloride. Another cause of inaccuracy complicates the result if the analyses be not made immediately after exposure; the darkened substance turns white again if left in the dark, probably owing to the formation of another oxychloride. The thoroughly dried darkened substance yields water on reduction in pure hydrogen, and also evolves oxygen on treatment with pure chlorine. The results of determinations of the constituents of the darkened product made by various analytical methods agree as well as could be expected. Silver chloride does not darken when exposed to light in absence of oxygen. No darkening was observed in a vacuum, in carbon dioxide, or in carefully purified carbon tetrachloride. It is, however, difficult to eliminate traces of alcohol, carbon disulphide, &c., from carbon tetrachloride, and the darkening caused by these impurities has hitherto been confounded with that caused by oxygen. Darkened silver chloride dissolves completely in boiling potassium chloride solution, and the solution so obtained contains caustic potash. The production of this free alkali seems to prove conclusively that oxygen is present in the darkened substance in the combined state.—The estimation of slag in wrought iron, by A. E. Barrows and T. Turner. Cast iron comparatively rich in non-metallic elements is known to afford a greater yield of puddled bar than do purer samples of iron. The loss on reheating and rolling into finished iron is, however, also greater. This difference has been attributed to intermingled slag. The authors prepared four samples of iron, viz. best bar, best sheet from the same bar, common bar, and common sheet from the same. Pig iron of known composition was used; the yield of common puddled bar was 6·5 per cent. greater than that of the other, but the loss on reheating was also 1·5 per cent. greater, leaving a balance of 5 per cent. in favour of the common iron. The results of analyses show that the silicon is equally, and very slightly, reduced in each case, whilst the phosphorus was much reduced in common iron, and but scarcely affected in best. This does not favour the view that much more slag is removed in one case than in the other. The authors conclude that for practical purposes the weight of slag in best and common iron may be taken as identical, and that on reheating and rolling each loses about the same weight of slag. The additional loss noticed on reheating impure iron is due chiefly to the elimination of phosphorus, probably in the form of ferrous phosphate. On attempting to estimate the slag by combustion in chlorine, a method already employed for cast iron, it was found that the slag was readily attacked by the gas at a very low red heat. An examination of the behaviour of a number of iron ores and slags showed that action occurs according to the equation $3FeO = Fe_2O_3 + Fe$; the free iron subliming as ferric chloride.—Corydaline, ii., by J. J. Dobbie and A. Lauder. Analyses of salts of corydaline are given in support of the formula $C_{22}H_{29}NO_4$, originally proposed by the authors for this alkaloid. The alkaloid employed by them is identical with that extracted by Adermann from the roots of *Corydalis cava.* Corydaline yields four molecular proportions of methyl iodide on treatment with concentrated hydriodic acid; the hydriodide of a new base $C_{18}H_{21}NO_4,HI$ is also obtained. The conclusion that corydaline contains four methoxy-groups is confirmed by the inability of the authors to obtain any definite reaction with phenylhydrazine or phosphorus pentachloride.—The action of bromine on allylthiocarbimide, by A. E. Dixon. Allylthiocarbimide readily combines with bromine, yielding dibromopropylthiocarbimide as an oily liquid which decomposes on distillation under ordinary pressures. This compound does not afford dibromopropylphenylthiourea when treated with aniline, but the two substances react with elimination of hydrogen bromide and formation of a compound of the formula $C_{10}H_{11}BrN_2S$, probably *n*-phenylbromotrimethylene-ψ-thiourea.—The hydrolytic functions of yeast, Part i., by J. O'Sullivan. It is generally stated, on the authority of Berthelot, that the water in which yeast has been washed possesses, like yeast itself, the power of hydrolyzing cane sugar, and that the active substance can be precipitated from the solution by means of alcohol. The author shows, however, that healthy yeast yields none of its invertase to water in which it is washed. When such yeast is placed in contact with sugar, hydrolysis is effected solely under the immediate influence of the plasma of the cell, no invertase leaving the cell while hydrolysis is taking place. A detailed account is given of experiments carried out under various conditions, which show that water which had been in contact with highly active yeast for various times had no hydrolytic power, although on the addition of a mere trace of invertase, it at once became active. The author therefore concludes that the resolution of cane sugar under the influence of yeast is entirely due to zymic hydrolysis.—The constitution of lapachic acid (lapachol) and its derivatives, by S. C. Hooker. Lapachic "acid" is found in a crystalline state in the grain of a number of South American woods, and derives its name from the lapach tree, which is plentiful in the Argentine Republic. On treatment with sulphuric acid, lapachol is converted into an isomeride generally known as lapachone. The author proposes to term this latter substance β-lapachone, it being a derivative of β-naphthaquinone. When lapachol is treated with concentrated hydrochloric acid, α-lapachone, a derivative of α-naphthaquinone is obtained. The author assigns the following constitutional formulæ to these three isomerides—



Lapachol.



α-Lapachone.



β-Lapachone.

It is shown that Paterno's isolapachone in reality contains less hydrogen than the lapachones, and is doubtless a β-naphthaquinone-propyl-furfuran.

Linnean Society, June 2.—Prof. Stewart, President, in the chair.—The Vice-Presidents for the year having been nominated by the President, a vote of thanks to the officers of the Society was proposed by Mr. Thomas Christy, seconded by Mr. C. J. Breese, and carried.—Mr. H. Bernard exhibited specimens and made remarks on the probably poisonous nature of the hairs and claws of an Arachnid (*Galeodes*).—On behalf of Capt. Douglas Phillott there was exhibited a curious case of malformation in the beak of an Indian parrakeet, *Palæornis torquatus.* The upper mandible was so abnormally decurved as almost to penetrate between the rami of the lower mandible, and although the bird was in good condition at the time it was shot by Capt. Phillott at Dera Ismail Khan, Punjab, in March last, it was evident that had it not been killed then, death must have soon ensued from a severance of the trachea by the sharp extremity of the prolonged mandible.—Mr. D. Morris exhibited, and made some very instructive remarks on, plants yielding Sisal hemp in the Bahamas and Yucatan, and pointed out their distribution and mode of growth. He also exhibited and described the preparation of a gut silk from Formosa and Kiungchow.—Mr. Scott Elliott gave a brief account of a journey he had recently made to the west coast of Africa, and described the character of the vegetation of the particular region explored, and the plants collected by him.—Mr. Jenner Weir exhibited and made remarks on a species of Psyche.—On behalf of Mr. Ernest Floyer, a paper was read by the Secretary on the disappearance of certain desert plants in Egypt through the agency of the camel.—Mr. F. Perry Coste gave an abstract of a paper on the chemistry of the colours in insects, chiefly Lepidoptera. The paper was criticized by Prof. Meldola, who was unable to accept the views expressed, the results of the experiments made being, in his opinion, inconclusive.—The meeting was brought to a close by the exhibition of an excellent oxyhydrogen lantern, recently presented to the Society by Dr. R. C. A. Prior, when Dr. R. B. Sharpe exhibited a number of coloured slides of birds designed to illustrate the interesting subject of mimicry and protective coloration.

Geological Society, June 8.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—The Tertiary microzoic formations of Trinidad, West Indies, by R. J. Lechmere Guppy. (Communicated by Dr. H. Woodward, F.R.S.) After giving an account of the general geology of the island, and noticing previous memoirs devoted to that geology, the author describes in detail the characters of the Naparima Beds, to which he assigns an Eocene and Miocene age. He considers that the Nariva Marls are not inferior to but above the Naparima Eocene Marls, and are actually of Miocene date. Details are given of the composition and characters of the "argiline," the foraminiferal marls occasionally containing gypsum, and the diatomaceous and radiolarian deposits of Naparima. The Pointapier section is then described, and its Cretaceous beds considered, reasons being given for inferring that there was no break between the Cretaceous and Eocene rocks of the Parian area. Detailed lists of the foraminiferal faunas of the marls are given, with notes. The author observes that the Eocene molluscan fauna of Trinidad shows no near alliances with other known faunas, thus differing from the well-known Miocene fauna of Haiti, Jamaica, Cuba, Trinidad, and other localities. Only one mollusk is common to the Eocene and Miocene of the West Indies. The shallow-water Foraminifera are found in both Eocene and Miocene, whilst the deep-water Foraminifera are nearly all of existing species. It would appear that during the Cretaceous and Eocene periods a sea of variable depth (up to 1000 fathoms) occupied the region now containing the microzoic rocks of Trinidad, whilst a mountain-range (which may be termed the Parian range) extended continuously from the north of Trinidad to the littoral Cordillera of Venezuela, forming the southern boundary of the Caribbean continent, and possessing no large streams to transport mechanical sediment into the Cretaceo-Eocene sea which opened eastward into the Atlantic. An appendix by Mr. J. W. Gregory deals with the microscopic structure of the rocks. The reading of this paper was followed by a discussion, in which the President, Dr. H. Woodward, Mr. J. W. Gregory, Mr. Vaughan Jennings, and Dr. Hinde took part.—The Bagshot Beds of Bagshot Heath (a rejoinder), by the Rev. A. Irving. —Notes on the geology of the Nile Valley, by E. A. Johnson Pasha and H. Droop Richmond. (Communicated by Norman Tate.) The rocks on either side of the Nile are chiefly Eocene (and Cretaceous?) from Cairo to Esneh; south of this is sandstone, which the authors believe to be Carboniferous, and to yield possible indications of coal, reaching to near Assouan, where it meets the granite and basalt of that region; a few miles south the sandstone begins again and continues to Wady Halfa, broken only by granite dykes. The granite is intrusive into and alters the sandstone, whilst the latter reposes upon the basalt and in some cases was deposited against upstanding basaltic masses. Unmistakable lavas occur near the Nile east of Minieh and west of Assiout. A description of some remarkable faults is given, and various minerals are noticed as occurring in the sedimentary rocks and the bed of an ancient river.

Mathematical Society, June 9.—Prof. Greenhill, F.R.S., President, in the chair.—Prof. Henrici exhibited a model of movable hyperboloids of one sheet. In 1873 he gave a student at University College the problem to construct a model of a hyperboloid of one sheet by fixing three sticks anyhow, placing others so as to cut these, and tying them together wherever they met. He told the student that the system would soon become rigid, but was surprised to find that this was not the case. It was easy to see the reason of this fact, and thus he established the theorem: If the two sets of generators of a hyperboloid be connected by articulated joints wherever they meet, then the system remains movable, the hyperboloid changing its shape. It was also soon found that each point moves during this deformation along the normal to the momentary position of the surface, and that therefore the different positions of the surface constitute a system of confocal hyperboloids. He then made a model such that the generators represented by sticks meet at points which lie on lines of curvature of the hyperboloids. These describe, therefore, confocal ellipsoids and hyperboloids of two sheets. In January 1874, Prof. Henrici exhibited this model at a meeting of the Society. Shortly afterwards a student made two copies of this model, and these were fastened together in such a manner that both could move together, remaining always confocal. It was this last model that was now shown. The properties of the movable hyperboloid became more widely known through a question which Prof. Greenhill set in 1878 at the Mathematical Tripos Examination, and this led Prof. Cayley to give a solution of it in the *Messenger of Mathematics*. Since that time several French mathematicians have made further investigation of the property in question. MM. Darboux and Mannheim, in particular, have made beautiful application of the deformable hyperboloid to the motion of a gyrating rigid body.—The following further communications were made:—The second discriminant of the ternary quantic, $x'u + y'v + z'w$, by Mr. J. E. Campbell. If the ordinary discriminant of this quantic in x, y, z, be formed, the result will be a quantic in x', y', z'. The discriminant of this latter the writer believes vanishes identically with certain exceptions. Prof. Henrici referred the author to a paper by himself in vol. ii. of the Society's Proceedings.—On the reflection and refraction of light from a magnetized transparent medium, by A. B. Basset, F.R.S. The object of this paper is to apply the theory of gyrostatically loaded media, to investigate the reflection and refraction of light at the surface of a magnetized transparent medium. This subject has been partially discussed by Mr. Larmor in a paper communicated to the Society last December, in which he has obtained the equations of motion of the medium; but the paper in question contains (Mr. Basset thinks) a certain amount of vague and obscure argument, founded upon general reasoning, which is calculated to envelop the subject in a cloud of mystery, rather than to enlighten the understanding. He, therefore, finds it necessary to write out the theory *de novo*, and to enter into a careful discussion respecting the boundary conditions. The principal results are as follows: When the magnetic force is parallel to the reflector, and also to the plane of incidence, the expressions for the amplitudes of the reflected light are the same as those which he obtained by means of an extension of the electromagnetic theory (see *Phil. Trans.*, 1891, p. 371); but when the magnetic force is perpendicular to the reflector, the above-mentioned expressions are of the same form as those furnished by the electromagnetic theory, with the exception that the signs of the magnetic terms are reversed. An experimental test of the relative merits of the two theories might probably be obtained by means of certain experiments performed by Prof. Kundt (*Berlin. Sitzungsberichte*, July 10, 1884; translated *Phil. Mag.*, October 1884), but the mathematical work, although presenting no difficulty, would be somewhat laborious. Having worked out these results, he endeavours to obtain a theoretical explanation of Kerr's experiments, on reflection from a magnet, by combining the theory of gyrostatically loaded media with the theory of metallic reflection, explained in his book on "Physical Optics," chapter xviii. sections 386-87; but the results are not entirely satisfactory. This, however, is not surprising, inasmuch as the theory of gyrostatically loaded media takes no account of the statical effects of magnetization.—Note on approximate evolution, by Prof. Lloyd Tanner. This note supplies a deficiency in a paper (Math. Soc. Proc., vol. xviii.) in which Prof. Hill pointed out the incorrectness of the rule for contracting the processes of finding the square and cube roots of a number—namely, it gives a practical test for determining the cases when the rule can, and when it cannot, be safely applied.—A proof of the exactness of Cayley's number of seminvariants of a given type, by Mr. E. B. Elliott, F.R.S.—Further note on automorphic functions, by Prof. W. Burnside.

Royal Meteorological Society, June 15.—Dr. C. Theodore Williams, President, in the chair.—The following papers were read:—English climatology, 1881-1890, by Mr. F. C. Bayard. This is a discussion of the results of the climatological observations made at the Society's stations, and printed in the *Meteorological Record* for the ten years 1881-1890. The instruments at these stations have all been verified, and are exposed under similar conditions, the thermometers being mounted in a Stevenson screen, with their bulbs 4 feet above the ground. The stations are regularly inspected, and the instruments tested by the Assistant Secretary. The stations now number about eighty, but there were only fifty-two which had complete results for the ten years in question. The author has discussed the results from these stations, and given the monthly and yearly means of temperature, humidity, cloud, and rainfall. His general conclusions are:—(1) With respect to mean temperature, the sea coast stations are warm in winter and cool in summer, whilst the inland stations are cold in winter and hot in summer. (2) At all stations the maximum temperature occurs in July or August, and the minimum in December or January. (3) Relative humidity is lowest at the sea coast stations, and highest at the inland ones. (4) The south-western district seems the most cloudy in winter, spring, and autumn, and the southern district the least cloudy in the summer months, and the sea coast stations are, as a rule, less cloudy than the inland ones. (5) Rainfall is smallest in April, and, as a rule, greatest in November, and it increases from east to west.—The mean temperature of the air on each day of the year at the Royal Observatory, Greenwich, on the average of the fifty years 1841 to 1890, by Mr. W. Ellis. The values given in this paper are derived from eye observations from 1841 to 1848, and from the photographic records from 1849 to 1890. The mean annual temperature is 49°·5. The lowest winter temperature, 37°·2, occurs on January 12, and the highest summer temperature, 63°·8, on July 15. The average temperature of the year is reached in spring, on May 2, and in autumn on October 18. The interval during which the temperature is above the average is 169 days, the interval during which it is below the average being 196 days.

SYDNEY.

Royal Society of New South Wales, May 4.—Annual Meeting.—H. C. Russell, F.R.S., President, in the chair.—The report stated that 61 new members had been elected during the year, and the total number on the roll on April 30 was 478. During the year the Society held eight meetings, at which the following papers were read:—Presidential address, by Dr. A. Leibius.—Notes on the large death-rate among Australian sheep in country infected with Cumberland disease or splenic fever, and Notes on a spontaneous disease among Australian rabbits, by Adrien Loir.—Compressed-air flying machines, Nos. 13 and 14, and on a wave-propelled vessel, by L. Hargrave.—A cyclonic storm or tornado in the Gwydir district; Preparations now being made in Sydney Observatory for the photographic chart of the heavens; Notes on some celestial photographs recently taken at Sydney Observatory; and Notes on the rate of growth of some Australian trees, by H. C. Russell, F.R.S.—Some folk-songs and myths from Samoa, translated by the Rev. G. Pratt, with introductions and notes, by Dr. John Fraser.—Notes on the use, construction, and cost of service reservoirs, by C. W. Darley.—On the constitution of the sugar series, by W. M. Hamlet.—On kaolinite from the Hawkesbury Sandstone, by H. G. Smith.—A contribution to the microscopic structure of some Australian rocks, by the Rev. J. Milne Curran.—On some New South Wales and other minerals (note No. 6), by Prof. Liversidge, F.R.S.—Artesian water in New South Wales (preliminary notes), by Prof. T. W. E. David.——The Medical Section held four meetings. The following papers were read :—A brief account of the histology and development of tubercle, by Prof. Anderson Stuart.—Remarks upon the nature and treatment of diphtheria, by Dr. W. Camac Wilkinson.—Glimpses of the past : a series of sketches with pen and pencil of the medical history of Sydney, by Dr. Honison.——The Microscopical Section held five meetings. The following paper was read :—Notes on slicing rocks for microscopical study, by the Rev. J. Milne Curran.——The Civil and Mechanical Engineering Section held eight meetings. The following papers were read :—Recent researches on the strength, elasticity, and endurance of materials of construction with especial reference to iron and steel, by Prof. Warren.—The bridge over Lane Cove River at the head of navigation, by H. H. Dare.—On the calculation of stresses by means of graphic analysis, by J. I. Haycroft.—On the tacheometer and its application to engineering surveys, by W. Poole, Jun.—On the sewerage of country towns : the separate system, by Dr. Ashburton Thompson.——The Clarke Medal for 1892 had been awarded to Prof. W. T. Thiselton Dyer, F.R.S. The Council had issued the following list of subjects with the offer of the Society's bronze medal, and a prize of £25 for each of the best researches if of sufficient merit :—(To be sent in not later than May 1, 1893) Upon the weapons, utensils, and manufactures of the aborigines of Australia and Tasmania ; on the effect of the Australian climate upon the physical development of the Australian-born population ; on the injuries occasioned by insect pests upon introduced trees. (To be sent in not later than May 1, 1894) On the timbers of New South Wales, with special reference to their fitness for use in construction, manufactures, and other similar purposes ; on the raised sea-beaches and kitchen middens on the coast of New South Wales ; on the aboriginal rock-carvings and paintings in New South Wales.—The Chairman read the Presidential address, and the Officers and Council were elected for the ensuing year, Prof. Warren being President.

PARIS.

Academy of Sciences, June 13.—M. d'Abbadie in the chair.—A new contribution to the history of the truffle, *Tirmania Cambonii*, "Terfâs" of Southern Algeria, by M. A. Chatin.—On subcutaneous or intra-venous injections of liquid extracts from several organs as a therapeutic method, by MM. Brown-Séquard and d'Arsonval.—In the place of the late Dom Pedro d'Alcantara, M. von Helmholtz was elected Foreign Associate.—Researches on the solar atmosphere, by Mr. George E. Hale, of the Kenwood Astrophysical Observatory, Chicago. A photograph of a metallic protuberance, obtained with an aperture of 12 inches and a large grating spectroscope, shows all the lines previously announced in the ultra-violet, and the following additional ones : 3961·7 (manganese?), 3900·7 (calcium), 3886·4 (hydrogen), and 3860·4 (iron?). The writer has succeeded in photographing faculæ in the centre of the disk.—On the general problem of the deformation of surfaces, by M. L. Raffy.—On the theory of the fuchsian functions, by M. Ludwig Schlesinger.—On transformations in mechanics, by M. P. Painlevé.—On considerations of homogeneity in physics, by M. A. Vaschy.—On the non-realization of the spheroidal state in steam boilers : reclamation of priority, by M. de Swarte.—On the co-existence of dielectric power and electrolytic conductivity, by M. E. Bouty. A rigid condenser is formed of iron disks separated by small wedges of mica, and joined by iron screws isolated by mica and placed opposite the wedges. This condenser is plunged into a fused mixture of equal parts of the nitrates of sodium and potassium. Air bubbles are carefully removed with plates of mica, and the condenser is withdrawn at the moment when the salt commences to solidify. The liquid, retained by capillarity, forms between the disks an adherent regular solid layer. The apparatus while yet hot is plunged into melted paraffin, which surrounds it with an isolating layer devoid of hygroscopic power. The experiments give a value for k approaching 4, and nearly constant within the limits of temperature in which the specific resistance in ohms may vary from $3·6 \times 10^{11}$ to $2·6 \times 10^{9}$, *i.e.* in the ratio of about 138 to 1. Here the conductivity and the dielectric capacity belong to molecules of the same kind. It is probable that if the experiments could be extended to ordinary electrolytes, they would give results of the same kind—that is, finite values of the dielectric constant k. The distinction between dielectrics and electrolytes would thus solely reside in the amount of their conductivity. Dielectric polarization, established in a very short time in comparison with the ten-thousandth of a second, would correspond, in Grotthuss's scheme, to the initial orientation of the compound molecules, their conductivity to their progressive rupture.—On the retardation in the perception of the different rays of the spectrum, by M. Aug. Charpentier. On suddenly illuminating the slit of a spectroscope by white light, the red portion of the spectrum is seen first, and the light seems to shoot across from the red to the violet. This was confirmed by rotating an inverted sector of a circle, 1 cm. broad at the base, and 8 to 10 cm. long once in two or three seconds. The extreme point seemed drawn out into a kind of spectrum extending from the red to the green. The maximum duration of excitation compatible with the isolation of the colours does not exceed about four or five thousandths of a second.—On the anhydrous crystallized fluorides of nickel and cobalt, by M. C. Poulenc.—Action of nitric oxide upon the metals, and upon the metallic oxides, by MM. Paul Sabatier and J. B. Senderens.—Thermochemical study of guanidine, of its salts and of nitroguanidine, by M. C. Matignon.—Researches on the disodic derivatives of the three isomeric diphenols, by M. de Forcrand.—On normal pyrotartaric or glutaric acid, by M. G. Massol.—Study of the decomposition of the diazo compounds, by MM. J. Hausser and P. Th. Muller.—The folds in the Secondary formations in the neighbourhood of Poitiers, by M. Jules Welsch.—On the genesis of the ophiolitic rocks, by M. L. Mazzuoli.—Three cases of increase in the velocity of transmission of sense-impressions, under the influence of injections of the testicular liquid, by M. Grigorescu.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Country Thoughts for Town Readers : K. B. B. de la Bere (Simpkin).—The Etiology and Pathology of Grouse Disease : Dr. E. Klein (Macmillan).—Marine Shells of South Africa : G. B. Sowerby (Sowerby).—Atlas of Clinical Medicine, vol i. : Dr. B. Bramwell (Edinburgh, Constable).—The Standard Course of Elementary Chemistry, Parts 1–5 : E. J. Cox (Arnold).—English Botany, Supplement to the Third Edition, Part 2 : N. E. Brown (Bell).—Volcanoes, Past and Present : Dr. E. Hull (Scott).—Den Norske Nordhaus-Expedition, 1876–78, xxi. Zoologi, Crinoida : D. C. Danielssen (Christiania, Grondahl).—Coal Gas as a Fuel, fourth edition : T. Fletcher (Liverpool, Tinling).

PAMPHLETS.—Twenty-second Annual Report of the Wellington College Natural Science Society, 1891 (Wellington College).—Johns Hopkins University of Baltimore Register for 1891–92 (Baltimore).—British Universities (Manchester, Cornish).

SERIALS.—Astronomy and Astro-Physics, June (Northfield, Minnesota).—L'Anthropologie, tome iii. No. 2 (Paris, Masson)—Journal of the Royal Microscopical Society, June (Williams and Norgate).—Contributions from the U.S. National Herbarium, vol. ii., No. 2 (Washington).—Bulletin of the New York Mathematical Society, vol. i. No. 9 (New York).

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